What is claimed is:

1.   A   control   apparatus   for   executing   a   contacting
process wherein a contact body is moved to come into contact
with a contacted body by an actuator from a state that the
contact body and the contacted body are spaced and opposed
each   other,   by   controlling   an   operation   of   a   contact
mechanism including the contact body movably provided in one
axial direction, the actuator for moving the contact body
connected therewith, and the contacted body making contact
with the contact body when the contact body is moved to a
predetermined position, comprising:
target position setting means for setting a target position
of the contact body in the contacting process;
actual   position   ascertaining   means   for   ascertaining   an
actual position of the contact body; and
operation amount   determining means for determining a first
operation amount   to drive the actuator so as to have a first
state amount converge on an equilibrium point on a first
switching function stipulated by a first linear function
having at least a deviation between the target position and
the actual position of the contact body as the first state
amount and this first state amount as a variable by using
response specifying-type control which can variably specify
a damping behavior and a damping speed of the deviation in
order to have the target position and the actual position of
the contact body to match.

2.   The   control   apparatus   of   the   contact   mechanism
according   to   claim   1,   wherein   the   operation   amount

determining means sets a computation coefficient of the first linear function depending on a actual position of a first engaging member.

3. The control apparatus of the contact mechanism according to claim 2, wherein in the contacting process, the operation amount determining means sets the computation coefficient in a direction that the control ability against a disturbance decreases, when the first engaging member is moved to a position where a distance between the first engaging member and the synchronizing member is less than a predetermined distance.

4. The control apparatus of the contact mechanism according to any one of claims 1 to 3, wherein the contact mechanism comprises a synchronizing mechanism for switching between transmission and cutoff of power;

the contact body comprises a first engaging member which is connected to an input shaft connected to a driving source or an output shaft connected to a driving wheel;

the contacted body comprises a synchronizing member which is provided rotatably to the first engaging member and a second engaging member and movably in the one direction between the first engaging member and the second engaging member connected to the shaft, either of the input shaft or the output shaft, to which the first engaging member is not connected, and makes contact with the first engaging member when the first engaging member is moved to a predetermined position, so that rotational speeds of the first engaging member and the second engaging member are synchronized in a state that the input shaft is rotated and thereby enabling

the first engaging member and the second engaging member to be engaged with each other;

and the contacting process comprises:

a first step in which the first engaging member is moved toward the second engaging member by the actuator to make the first engaging member to come into contact with the synchronizing member; and

a second step in which, subsequent to the first step, the first engaging member is pressed against the synchronizing member by the actuator, and thereby synchronizing the rotational speeds of the first engaging member and the second engaging member through the synchronizing member to engage the first engaging member and the second engaging member each other.

5. The control apparatus of the contact mechanism according to claim 4, wherein the operation amount determining means starts a processing in response to the second step when a degree of separation of the actual position of the first engaging member to the target position increases higher than a first predetermined level in the first step.

6. The control apparatus of the contact mechanism according to claim 5, wherein the operation amount determining member has pressing force ascertaining means for ascertaining a pressing force to the synchronizing member caused by the first engaging member, and the computation coefficient of the first linear function is set so as to match the pressing force determined by the pressing force ascertaining means with a predetermined target pressing

force in the second step.

7. The control apparatus of the contact mechanism according to claim 6, wherein the operation amount determining means determines the first operation amount to stop the first engaging member from moving, when the degree of separation of the actual position of the first engaging member to the target position decreases more than the second predetermined level in the second step.

8. The control apparatus of the contact mechanism according to claim 7, wherein the operation amount determining means sets the computation coefficient in the direction that the control ability against the disturbance increases, when the degree of separation of the actual position of the first engaging member to the target position decreases more than the predetermined level in the second step.

9. The control apparatus of the contact mechanism according to claim 8, wherein the operation amount determining means ascertains the degree of the separation of the actual position of the first engaging member to the target position based on a transformation value with which filtering using a wavelet transformation is applied to time series data of a deviation between the actual position of the first engaging member and the target position.

10. The control apparatus of the contact mechanism according to claim 6, wherein the operation amount determining means sets the computation coefficient so as to have a second state amount converge on an equilibrium point on a second switching function stipulated by a second linear

function having at least the deviation as the second state amount, the computation coefficient as a second operation amount, and the second state amount as a variable, by using the response specifying-type control which can variably specify a damping behavior and a damping speed of the deviation between the target pressing force and the pressing force determined by the pressing force ascertaining means to have the target pressing force and the pressing force ascertained by the pressing force ascertaining means to match in the second step.

11. The control apparatus of the contact mechanism according to claim 10, wherein the actuator is an electric actuator in which an output changes depending on an value of an electric current to be supplied, the first operation amount is an electric voltage supplied to the electric actuator, and the pressing force ascertaining means detects the electric current supplied to the electric actuator to ascertain a pressing force to the synchronizing member caused by the first engaging member based on the value of the supplied electric current.

12. The control apparatus of the contact mechanism according to claim 10, wherein the operation amount determining means uses adapting sliding mode control as the response specifying-type control based on the first switching function.

13. The control apparatus of the contact mechanism according to claim 12, wherein the operation amount determining means calculates the first operation amount according to a sum of an equivalent control input calculated

by using a value of the first linear function, a reaching rule input, and an adapting rule input, so that a gain of the reaching rule input and a gain of the adapting rule input are set at values satisfying a stability condition that the first state amount converges on the first switching function.

14. The control apparatus of the contact mechanism according to claim 10, wherein the operation amount determining means uses a control for calculating a control input depending on the value of integration of the first switching function as the response specifying-type control based on the first switching function.

15. The control apparatus of the contact mechanism according to claim 14, wherein the operation amount determining means calculates the first operation amount according to a sum of a proportional term of the equivalent control input calculated by using the first linear function and the first switching function and an integral term of the first switching function, and thereby setting a gain of the proportional term of the first switching function and a gain of the integral term of the first switching function at the values satisfying the stability condition that the first state amount converges on the first switching function.